GULF STREAM - BOUNDARY INTERACTIONS

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LONG-TERM GOAL

This project seeks to understand the influence of the Gulf Stream, as well as other midlatitude jets, on the surrounding ocean through such processes as meandering and radiation of low frequency energy.

SCIENTIFIC OBJECTIVES

The guiding hypothesis is that Gulf Stream meandering acts as a wavemaker in the ocean. Because this meandering results primarily from the barotropic instability process, the meanders are also quite depth independent and force mainly barotropic motions exterior to them. These motions propagate as low frequency Rossby waves and those to the north of the stream eventually become topographic Rossby waves as they begin to feel the bottom topography. Based on theoretical and numerical modeling, two regions of enhanced coupling are predicted: near Cape Hatteras and to the west of the Grand Banks. We wish to discover whether or not this process is observed in the ocean.

APPROACH

An array of current meters was deployed in late summer of 1995 on the Continental Rise to the west of the Grand Banks (near 53W) to record low frequency motions for a two year period. The array was composed of 2 lines of current meter moorings, one of which was coincident with a track of the Topex/Poseidon altimetric satellite. The equipment was recovered successfully in September 1997 and the resulting data will be compared with the climatological data base for the region, as well as the altimetric information, to discover whether or not this is a region of enhanced low frequency energy.

WORK COMPLETED

As the current meter was recovered just one month ago we have not had any opportunity for detailed scientific analysis. Instead, we have been assembling the Topex/Poseidon data set and using it to search for clues of radiation processes on the regional scale, and continuing work of a more theoretical nature on the role that the meandering Gulf Stream plays in forcing recirculation gyres.

RESULTS

The moored array was successfully recovered in September 1997. Of the 9 moorings in the original array 8 were retrieved. The single missing mooring had been fished up early in the observational period, reset, and then fished up again within a few weeks. Consequently, it was not reset for a 3rd time. The instruments performed quite well and returned in excess of 90% of expected data.

Work on the recirculation problem has continued (with Paula Rizzoli and graduate student Steve Jayne) with simple reduced gravity and two layer models. We have discovered, empirically, a universal scaling law that predicts the recirculation intensity as a function of environmental parameters but, as of yet, have been unable to come up with a convincing theoretical argument.

IMPACT/APPLICATION

We anticipate that the work with the current meter data set will give a better understanding of the origins of the energetic low frequency motion field that is observed on the Continental Slope and Rise. These motions are a dominant part of the total energy in these regions.